UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/941,356	08/29/2001	Jane-Bai Lai	67,200-473	4315

7590 07/30/2003

TUNG & ASSOCIATES
838 W. Long Lake Road, Suite 120
Bloomfield Hills, MI 48302

EXAMINER
UMEZ ERONINI, LYNETTE T

ART UNIT	PAPER NUMBER
1765	4

DATE MAILED: 07/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/941,356	LAI ET AL.	
	Examiner	Art Unit	
	Lynette T. Umez-Eronini	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7 and 23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 8 and 21 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 8; and

In claim 21, "and so that the etching does not stop on the low dielectric constant material and the dielectric layer is etched" raises new matter, which lacks support from the Specification. "According to the present invention at least one layer of a low dielectric constant interlayer dielectric in a semiconductor device is etched by an aqueous solution including hydrofluoric acid (HF) and hydrochloric acid (HCl)" (see Specification, p. 10, [0052]), fails to support the said limitation that requires etching that does not stop on the low dielectric constant material.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 8, 12, 13, 14, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski (US 6,078,088) in view of Weber ('416).

As pertaining to claims 8, 14, 18, and 20, Buynoski teaches providing a semiconductor device having at least two metal interconnect layers and a low dielectric constant material between the metal interconnect layer (column 5, lines 5-8 and 45-59 and FIGS. **1-4**).

Buynoski differs in failing to teach etching the device with HF and HCl and so that the etching does not stop on the low dielectric constant material and the dielectric layer is etched, **in claim 8**.

Weber teaches a hydrochloric acid and hydrofluoric acid tend to preferentially etch the interface region between a metal electrode and a substrate such as polyimide (low dielectric constant material), (column 4, lines 21-24), which reads on etching a semiconductor device in an aqueous solution of hydrofluoric acid and hydrochloric acid.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski by using Weber's method of etching the device with HF and HCl and to not only control the

etching so that etching does not stop on the low dielectric constant material but also to etch the dielectric layer for the purpose of not degrading or destroying the amorphous silicon device (Weber, column 4, lines 1-6).

Buynoski further teaches using various metals for the interconnection system, such as aluminum and copper (column 6, lines 13-15), which respectively reads on,

the metal interconnect comprises aluminum, **in claim 13** and the metal interconnect consists essentially of copper, **in claim 12**.

5. Claims 9 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber ('416) as applied to claim 8 above, and further in view of Asam (US 4,199,337).

Buynoski in view of Weber differs in failing to teach the weight ratio of hydrofluoric acid to hydrochloric acid in the solution ranges from 1:3 to 4:1 and 1:1 to 5:1, respectively **in claims 9 and 17**.

Asam teaches the etching step may be controlled by regulating the etchant concentration (column 5, liens 50-52).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber by regulating the etchant concentration (same as applicant's the weight ratio) as taught by Asam, which provides evidence that the etchant concentration (weight ratio) is a so-called "result effective variable," since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 f.2d 272, 206 USPQ 215 (CCPA 1980).

6. Claims 10, 11, 15, 19, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber (416) as applied to claim 8 above, and further in view of Tobben et al. (US 5,977,635).

Buynoski in view of Weber differs in failing to teach the low dielectric constant material includes OR groups wherein R is a hydrocarbon derivative, **in claim 10**; includes methoxy groups, **in claim 11**; has a dielectric constant less than 3.8, **in claim 15**; comprises an organosilicon, **in claim 19**; and includes $Si(CH_3)_xO_{2-x}$, **in claim 22**.

Tobben teaches a low dielectric constant material such as methyl silsesquioxane (same as applicant's $CH_3SiO_{1.5}$), (column 5, lines 51-55), which includes an OCH_3 (the same as an OR group where R is a hydrocarbon derivative) and which is an organosilicon.

It is the examiner's position that it would have been obvious to modify Buynoski in view of Weber by using a low dielectric constant material such methyl silsesquioxane (which has the same general formula as applicant's low dielectric constant material that includes $Si(CH_3)_xO_{2-x}$), which includes OR groups wherein R is a hydrocarbon derivative; a methoxy group; $Si(CH_3)_xO_{2-x}$ and that comprises as organosilicon, as taught by Tobben for the purpose of improving the multi-level conductive structures that reduce the capacitive coupling among their various conductive lines and plugs in order to improve performance (Tobben, column 2, lines 59-63).

7. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber (416), as applied to claim 8 above, and further in view of Gardner (US 6,080,640).

Buynoski in view of Weber differs in failing to teach the low dielectric constant material comprises fluorosilicate, **in claim 16**.

Gardner teaches, "Examples of low K dielectric material may be . . . one of the following materials: fluorosilicate glass (FSG), . . ." which reads on the low dielectric constant material comprises fluorosilicate.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber by using a low dielectric constant material comprising fluorosilicate glass as taught by Gardner for the purpose of minimizing the capacitative effects, which assists in improving the operation speed of the device (Gardner, column 8, lines 38-49).

8. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber ('416) as applied to claim 8 above, and further in view of Lee et al. (US 6,251,752 B1).

Buynoski in view of Weber differs in failing to teach analyzing the etch device in a scan electron microscope.

Lee teaches a structure (electronic) is then etched in a wet etchant such that it may be observed in SEM for studying the characteristic feature or defect and its reason for being defective (column 2, lines 52-54).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber by using Lee's method of analyzing an etched device for the purpose of revealing the characteristic feature and defects of a structure (Lee, lines 52-54).

9. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber ('301).

Buynoski teaches providing a semiconductor device having at least two metal interconnect layers and a low dielectric constant material between the metal interconnect layer (column 5, lines 45-59 and FIGS. **1-4**).

Buynoski differs in failing to teach etching the device with HF and HCl.

Weber teaches a hydrochloric acid and hydrofluoric acid tend to preferentially etch the interface region between a metal electrode and a substrate such as polyimide (low dielectric constant material), (column 4, lines 21-24), which reads on etching a semiconductor device in an aqueous solution of hydrofluoric acid and hydrochloric acid.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski by using Weber's method of etching the device with HF and HCl and to not only control the etching so that etching does not stop on the low dielectric constant material but also to etch the dielectric layer for the purpose of not degrading or destroying the amorphous silicon device (Weber, column 4, lines 1-6).

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703-308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703-972-9310 for regular communications and 703-972-9311 for After Final communications.

ltue
July 28, 2003

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700